Title: Modeling the Effect of Olivocochlear Efferents on the Subcortical Envelope Following Response in Humans

Christopher J. Smalt*, Michael G. Heinz**, Elizabeth A. Strickland**

*MIT Lincoln Laboratory, Lexington MA, USA
**Purdue University, West Lafayette, IN

The medial olivocochlear reflex (MOCR), a feedback mechanism that controls gain of the outer hair cells, is thought to provide protection and enhancement for a listener in background noise. This listening advantage can be attributed to a suppression of auditory nerve firing, which results in an increased dynamic range for encoding a signal of interest (e.g. a tone or speech). The computational model presented here updates the work of Smalt et al. (2014), which added some of the dynamic characteristics of the MOCR with the more recent "humanized" version (Zilany, et al., 2014). This effect of the model is to effectively reduce the outer hair cell gain, depending on the stimulus frequency, level, and timing. Human Envelope Following Responses (EFRs) were compared to Nelson and Carney (2004) Inferior Colliculus (IC) model output used in conjunction with the MOCR auditory nerve model. Adding simultaneous contralateral noise did not significantly affect the model IC modulation filter energy at the stimulus frequency, while a 500 ms contralateral noise precursor increased the output by approximately 3 dB, consistent with observations in humans (Bharadwaj, 2015). Further study of the auditory nerve model with the MOCR may help to understand human susceptibility to noise-induced hearing loss, damage to low-spontaneous rate auditory nerve fibers, as well as develop new algorithms for hearing aids that are able to restore normal speech perception in noise.

Funding
DISTRIBUTION STATEMENT A. Approved for public release: distribution unlimited.
This material is based upon work supported under Air Force Contract No. FA8721-05-C-0002 and/or FA8702-15-D-0001. Any opinions, findings, conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the U.S. Air Force.